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### IMPROVED OAT VARIETIES FOR THE CORN BELT

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#### INTRODUCTION

Oats are grown over much of the United States, but the greater portion of the crop is produced in a belt extending westward from New York to North Dakota and south to the latitude of the Ohio River. From Ohio westward this area coincides very largely with the Corn Belt, and it is in this belt that the greater part of the oat crop is produced. This is shown by the data presented in Table 1, which gives the oat acreage and production for the 12 North-Central States in 1919. In that year these 12 States contained three-fourths of the total acreage and produced nearly four-fifths of the total crop of the United States.

In the Corn Belt oats are exceeded in importance only by corn. This importance is due primarily to the fact that the oat is the most satisfactory intermediate crop to grow between corn and wheat or between corn and grass in those rotations which long practice has shown to be the most profitable in this area.



TABLE 1.—*Oat acreage and production in each of the 12 States comprising the spring-oat belt, with totals for that area and for the United States in 1919*

[Data compiled from the Thirteenth Census]

State	Acres	Bushels	State	Acres	Bushels
Iowa.....	5,484,113	187,045,705	Missouri.....	1,707,055	40,493,700
Illinois.....	4,291,066	129,104,668	Michigan.....	1,514,808	36,956,425
Minnesota.....	3,429,079	89,108,151	Ohio.....	1,452,052	46,818,330
Wisconsin.....	2,251,919	68,296,223	Kansas.....	1,415,928	36,257,356
North Dakota.....	2,073,162	30,294,074			
Nebraska.....	2,029,740	59,819,545	North-Central States.....	29,206,759	827,815,864
South Dakota.....	1,839,089	51,091,904	United States.....	37,991,002	1,055,182,798
Indiana.....	1,718,748	52,529,723			

In this bulletin there are discussed four new varieties of oats which have achieved a marked success in the Corn Belt and which in Iowa and adjacent States where they are adapted have added materially to production. These varieties were developed by the Iowa Agricultural Experiment Station in cooperation with the Bureau of Plant Industry of the United States Department of Agriculture. The four varieties, in the order of their distribution, are Albion (Iowa No. 103), Richland (Iowa No. 105), Iowar, and Iogren (Cereal Investigations Nos. 729, 787, 847, and 2024, respectively).

### HISTORY AND METHODS OF OAT EXPERIMENTS

The experiments to develop improved varieties of oats for Iowa and the Corn Belt in general were begun in 1906. At harvest of that year 450 individual plant selections were made by the senior writer from the fifty-odd varieties and strains then being grown in the experimental plats of the Iowa station. With this as a beginning, more than 20,000 pure lines have since been isolated and studied, and 1,544 of these have been of sufficient merit to warrant continuation in the nursery for at least three years. From the nursery, 150 of the best strains have been increased and advanced to the plat experiments, and of these superior strains four have been found so outstanding that they have been increased, named, and distributed to farmers. A harvested oat nursery at the Iowa Agricultural Experiment Station is shown in Figure 1.

The methods of isolating pure lines and studying them in the nursery have been described in a previous publication.<sup>1</sup> The plat experiments in which the merit of the 150 best strains was finally determined have been conducted under conditions conforming to good farm practice. Judgment as to the value of these strains has been based on average yields when grown in comparison with the best adapted commercial varieties for a series of years. Harvesting oat varieties grown in plats at the Iowa Agricultural Experiment Station is shown in Figure 2.

In order to determine the wider adaptation and performance of the improved varieties developed at the Iowa station, it was necessary that they be grown at various other points throughout the State. To make this possible there was organized the Iowa Agricultural Experiment Association, made up of farmers who agreed to

<sup>1</sup> Warburton, C. W., Burnett, L. C., and Love, H. H. Tests of selections from hybrids and commercial varieties of oats. U. S. Dept. Agr. Bul. 99, 25 pp., illus. 1914.



test improved varieties in comparison with standard commercial varieties under conditions as nearly identical as possible and to report their results to the association. The secretary of the association is a member of the staff of the Iowa Agricultural Experiment Station. Reports covering 971 comparative trials of this kind so far have been accumulated. In addition to supplying needed information, the grain threshed from these farm plats usually has been sown again on the same farms, these farms serving as seed-growing centers from which the improved varieties have been widely distributed.

#### ALBION (IOWA NO. 103)

Experiments conducted prior to 1906 demonstrated that Kherson was one of the most dependable varieties of oats grown in the Corn

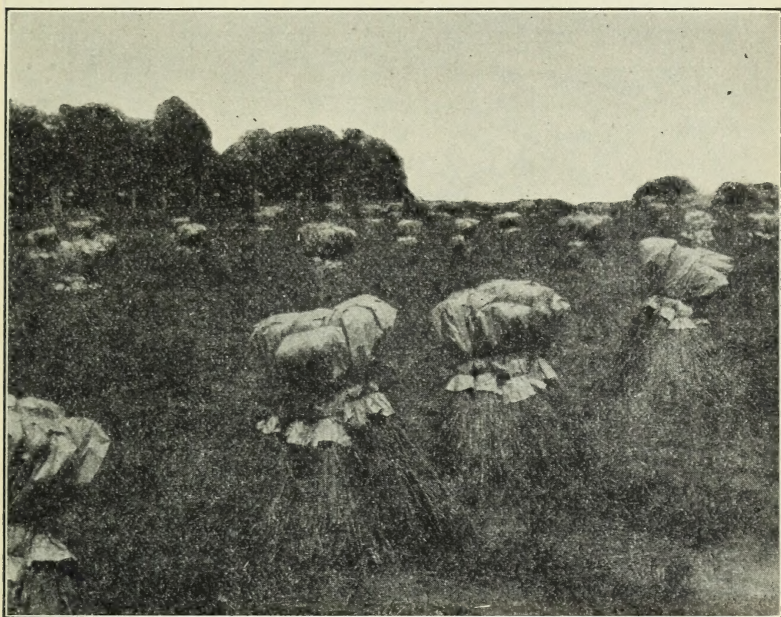


FIG. 1.—Harvested oat nursery at the Iowa Agricultural Experiment Station

Belt. The importance of the variety in this area is shown by the distribution map (fig. 3). On account of its yellow color it was discriminated against in the markets, and other varieties inferior to Kherson were grown, primarily because of their better color. There was a demand for a white oat with the vigor and yield of Kherson to replace these inferior varieties. Albion, a white strain of Kherson, was the first pure-line oat variety developed in the co-operative cereal experiments at the Iowa Agricultural Experiment Station. The history and description of this variety follow.

#### HISTORY AND DESCRIPTION

*History.*—Albion originated from a single white-kerneled plant selected from Kherson in 1906 by the senior writer. This selection



was designated as Iowa No. 103. From 1906 to 1909 it was grown in the nursery, and in 1909, because of its nursery record, the first increase plat was grown. In 1910 it was placed in the plat varietal experiments. The variety was first distributed to Iowa farmers in 1913, distribution being continued by the Iowa Agricultural Experiment Station until 1917. From this wide distribution in Iowa the Albion spread to adjoining States and is to-day the leading early variety in Iowa and Illinois, although it is being replaced to some extent by the higher yielding selection Iowar, which is discussed elsewhere in this bulletin.

In 1919 Iowa grew slightly more than 1,000,000 acres of the Albion variety. Over 300,000 acres were grown in Illinois. The States

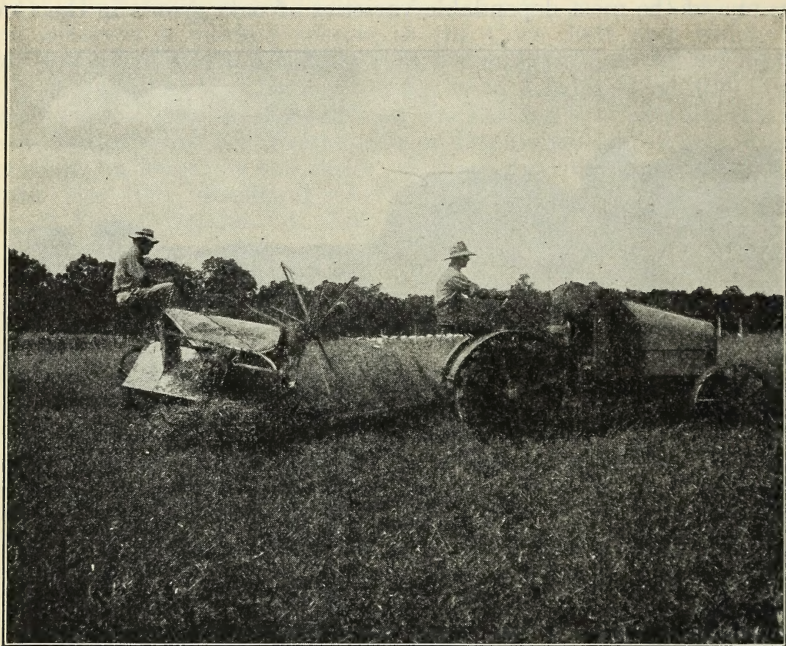


FIG. 2.—Harvesting Iowar oats on the Agronomy Farm of the Iowa Agricultural Experiment Station

of Minnesota, Missouri, Nebraska, South Dakota, and Wisconsin each grew from 11,000 to 19,000 acres in that year. At the then average farm price of 72 cents a bushel for oats and an average gain in yield of 3 bushels per acre p. 9), Iowa alone received a net gain of more than \$2,000,000 from this variety in that year. The distribution of Albion in 1919 is shown in Figure 4.

A more recent survey made by the Iowa Agricultural Experiment Station shows that in 1924 Albion was grown on 23.2 per cent (1,332,608 acres) of Iowa's total oat acreage of 5,744,000 acres, as compared with 8.7 per cent (499,728 acres) for Richland, 13.5 per cent (775,440 acres) for Iowar, and 0.8 per cent (45,952 acres) for Iogren. These figures indicate that the Albion has been well received by the farmers of Iowa.



*Description.*—Early growth erect; plant early. Culms slender, weak, glabrous, sometimes slightly pubescent at the nodes, 60 to 90 centimeters tall. Sheaths deep green, glabrous; culm leaves narrow, margins glabrous. Peduncle slender, straight, usually well exerted. Panicle equilateral, usually erect, short, narrow to midbroad, ovate; rachis nodes five to six; branches short to midlong, usually ascending, scabrous. Spikelets few to numerous, 2-flowered, occasionally 3-flowered; kernel slender. Empty glumes 20 to 24 millimeters long, 5 to 7 millimeters wide, 8 to 9 veined, light green before maturity. Lower lemma 15 to 18 millimeters long, glabrous, white to slightly grayish white; basal hairs very few or wanting; awns few to abundant, straight (nontwisted) to twisted and frequently geniculate, 15 to 35 millimeters long. Upper lemma 10 to 13 millimeters long, awnless. Rachilla segment midlong, usually glabrous.

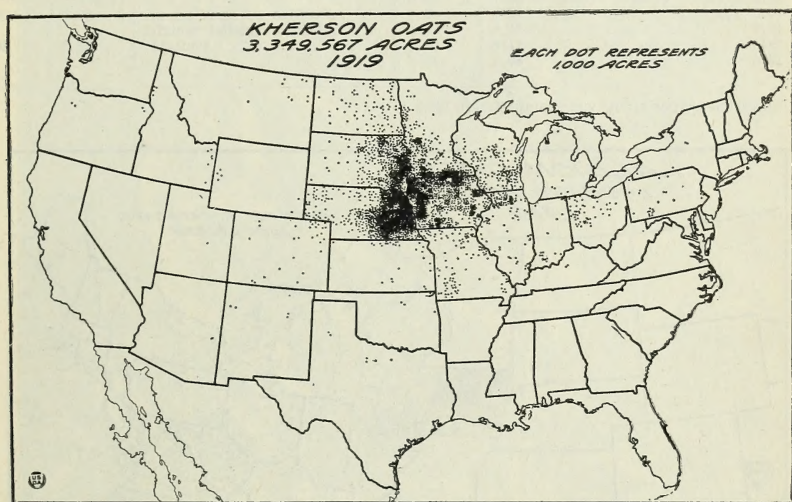


FIG. 3.—Outline map of the United States, showing distribution of the Kherson oat in 1919

The Albion differs primarily from Kherson, the parent variety, in having white lemmas and usually more awns. The straw and glumes are of a creamy yellow at maturity. The variety ripens one day earlier than Kherson and two days later than Early Champion, which was formerly a standard early variety on Iowa farms. A panicle and spikelets of Albion are shown in Figure 5.

#### YIELDS OF ALBION

##### EXPERIMENTS AT THE IOWA STATION

As the white-kerneled Albion was developed primarily as a substitute for the yellow Kherson, the two should be compared. Table 2 shows the average date of sowing, date of ripening, height of plant, percentage of lodging, bushel weight, and annual and average yields of grain of Albion and Kherson oats at the Iowa Agricultural Experiment Station for the 13 years from 1910 to 1919, inclusive, and

in 1921, 1922, and 1923. The rate of seeding for each variety was 3 bushels per acre in all years.

TABLE 2.—Average dates of sowing and of ripening, height of plant, percentage of lodging, bushel weight, and annual and average acre yields of the Albion and Kherson oat varieties at the Iowa Agricultural Experiment Station for the 13 years from 1910 to 1919, inclusive, and in 1921, 1922, and 1923<sup>1</sup>

Items of comparison	Albion	Kherson	Items of comparison	Albion	Kherson
Average date sown.....	Apr. 14	Apr. 14	Acre yield of grain (bushels)—		
Average date ripe.....	July 12	July 13	Continued.		
Average height of plant			1917.....	73.7	65.0
.....inches.....	35.0	34.0	1918.....	48.7	62.5
Average percentage of lodging.....	3.2	1.0	1919.....	32.2	41.9
Acre yield of grain (bushels):			1921.....	37.4	25.9
1910.....	55.4	62.2	1922.....	58.7	67.1
1911.....	40.6	38.1	1923.....	68.7	78.7
1912.....	53.7	65.6			
1913.....	63.7	62.8	Average.....	52.0	56.0
1914.....	55.6	55.3	Average bushel weight		
1915.....	41.6	49.7	.....pounds.....	30.3	30.3
1916.....	46.1	53.8			

<sup>1</sup> No varietal experiments were conducted in 1920.

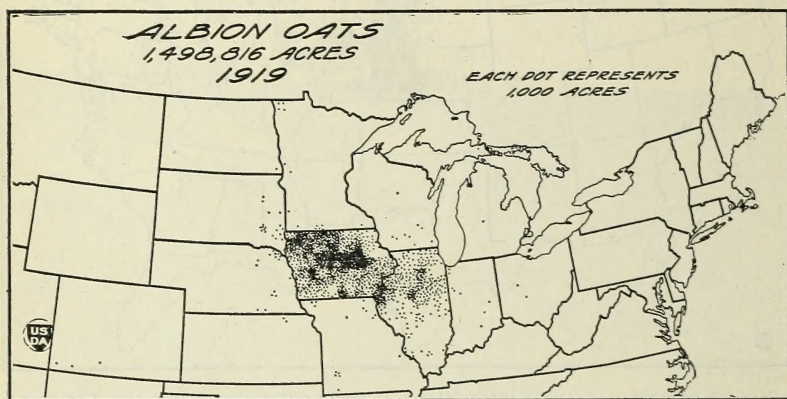


FIG. 4.—Outline map of a portion of the United States, showing distribution of the Albion oat in 1919

Table 2 shows that Albion is one day earlier than Kherson in maturity. In height of plant there is practically no difference. In yield, the original Kherson is superior, and in bushel weight they are practically equal.

A statistical study<sup>2</sup> of the yields given in Table 2 indicate that there is no significant difference between the yielding power of the two varieties. The odds are only 19.6 to 1 that Kherson is a higher yielding variety than Albion. Odds as small as this are of little significance.

While the results obtained from the Albion oat in nursery experiments during 1907 and 1908 indicated that it was equal to the parent variety in yield and vigor, these indications were not substantiated by the results obtained from the early plat experiments, as shown

<sup>2</sup> Anonymous. The probable error of a mean, by Student. *In* Biometrika, vol. 6, pp. 1-25. 1908.



in Table 2. Nevertheless, it was believed that the white hull of the kernel was of sufficient importance to warrant its increase and distribution to farmers to determine its value under farm conditions. The farm record of the variety fully justified this decision

#### EXPERIMENTS ON IOWA FARMS

Yields of Albion in comparison with Kherson were obtained on 66 Iowa farms during the five-year period from 1913 to 1917, inclusive,



FIG. 5.—Panicles and spikelets of the Albion (left) and Richland (right) oat varieties

through the cooperation of the Iowa Agricultural Experiment Association and the Iowa Agricultural Experiment Station, previously mentioned. In Table 3 are given the summarized yields from these tests.

According to the data presented in Table 3, Albion outyielded the original Kherson variety on Iowa farms by an average of 3.02 bushels per acre. These yields, therefore, indicate that Albion is more productive than Kherson on Iowa farms, even though it has been inferior to Kherson in the experiments at the Iowa Agricultural Experiment Station, as shown in Table 2. The relative yielding

power of the two varieties as indicated by the mean yields from the 66 comparative tests is shown graphically in Figure 6. Space does not permit the presentation of the detailed data from these experiments.

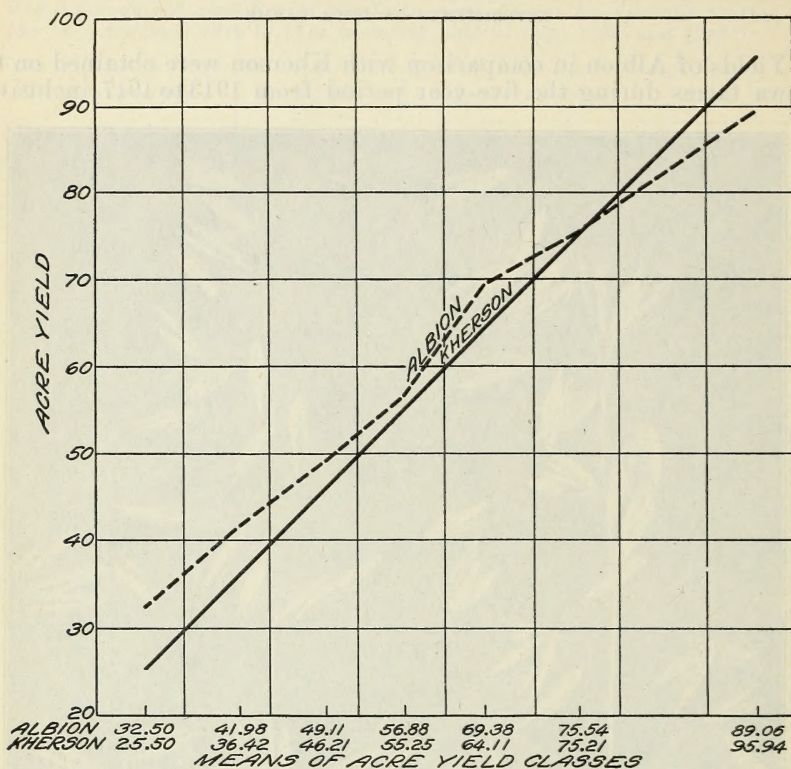


FIG. 6.—Diagram showing the mean acre yields (in bushels) of Albion as compared with those of Kherson as a standard oat variety in 66 trials on Iowa farms during the 5-year period from 1913 to 1917, inclusive.

TABLE 3.—Annual average and weighted average yields of the Albion and Kherson oat varieties grown on 66 Iowa farms during the five-year period from 1913 to 1917, inclusive

Year	Number of trials	Acre yield of grain (bushels)		
		Albion	Kherson	Difference
1913.....	12	49.84	46.88	2.96
1914.....	6	47.58	43.95	3.63
1915.....	15	60.71	58.23	2.48
1916.....	21	49.73	46.17	3.56
1917.....	12	61.15	58.66	2.49
Weighted average of all trials.....	66	54.13	51.11	3.02

Albion also was compared in a similar way with several other varieties on Iowa farms, altogether 267 trials being conducted during the five years from 1913 to 1917, inclusive. The summarized



results are presented in Table 4. The home-grown varieties and the number of trials in which each was compared with the Albion were as follows: Swedish Select 37, Silvermine 20, Early Champion 26, Kherson 66, Green Russian 34, miscellaneous 27, and unknown varieties 57.

TABLE 4.—Average yields of Albion and other common varieties of oats grown on 267 Iowa farms during the five-year period from 1913 to 1917, inclusive

Home-grown variety	Number of trials	Acre yield of grain (bushels)		
		Albion	Home-grown variety	Difference
Swedish Select.....	37	46.98	39.74	7.24
Silvermine.....	20	51.07	44.70	6.37
Early Champion.....	26	50.38	46.00	4.38
Kherson.....	66	54.13	51.11	3.02
Green Russian.....	34	52.51	49.57	2.94
Miscellaneous varieties.....	27	48.91	42.82	6.09
Unknown varieties.....	57	48.83	45.56	3.27
Weighted average of all trials.....	267	50.68	46.34	4.34

The data of Table 4 show an average annual gain of 4.34 bushels per acre for Albion over these home-grown varieties. Some of the difference probably was due to the better quality of the Albion seed, as this seed was always cleaned and prepared by the Iowa station. Allowing a reasonable reduction for this factor, it is safe to estimate that the variety has raised the average yields on the fields where it has been grown in Iowa by at least 3 bushels per acre.

#### RATIO OF GRAIN TO STRAW

Albion is an early variety and, as would be expected, has a comparatively high yield of grain in proportion to straw. For three years the soils section of the Iowa Agricultural Experiment Station used this variety on the fertility plats at the station farm. The average acre yield of grain on 59 plats in 1915, 1916, and 1917 was 60.9 bushels (1,948.8 pounds). The average yield of grain from 1 ton of bundles was 1,124 pounds, or 56 per cent grain and 44 per cent straw by weight.

TABLE 5.—Acre yield and bushel weight of the Albion oat sown at varying rates at the Iowa Agricultural Experiment Station in 1912

Specification	Rate of seeding per acre						Average
	2 bushels	2½ bushels	3 bushels	3½ bushels	4 bushels	4½ bushels	
Acre yield.....bushels..	81.25	82.40	87.90	80.90	78.10	76.60	81.19
Bushel weight.....pounds..	30.75	31.50	32.00	32.00	32.00	33.00	31.88

#### RATE-OF-SEEDING EXPERIMENTS

The Albion oat was grown in a rate-of-seeding experiment in 1912 only. The data obtained in this experiment are shown in Table 5.

While these data are too limited for conclusions, their trend is similar to that of more extensive data obtained with other similar varieties, and in seeding this variety the Iowa station has used and recommended the 3-bushel rate.

#### RICHLAND (IOWA NO. 105)

Richland, a yellow strain of Kherson, was the second pure line of that variety developed in the cooperative cereal experiments at the Iowa Agricultural Experiment Station. The history and description of this strain follow.

#### HISTORY AND DESCRIPTION

*History.*—Richland is a companion strain of Albion and therefore has practically the same history. Like Albion, the original plant selection from Kherson was made by the senior writer in 1906. This selection was given the designation Iowa No. 105. It was grown in nursery experiments during the years 1907, 1908, and 1909 and was then advanced to the plat experiments. Owing to the excellent yields shown in these trials it was increased and first distributed to the farmers of Iowa in 1914. During the four succeeding years up to and including 1918, this increase and distribution of Richland were continued.

In productiveness, Richland has been one of the very best strains of Kherson so far isolated. Its yielding ability together with its earliness and short, rather stiff straw makes this strain particularly adapted for growing on soils of high fertility where other varieties usually lodge. The name Richland is a recognition of this fact.

*Description.*—Early growth erect; plant very early. Culms slender, stiff, glabrous or occasionally slightly hairy at the nodes, 55 to 85 centimeters tall. Sheaths deep green, glabrous; culm leaves narrow, margins glabrous. Peduncle slender, straight, usually well exerted. Panicle equilateral, usually erect; short, narrow to mid-broad, ovate; rachis nodes five to six; branches short to midlong, usually ascending, scabrous. Spikelets few to numerous, 2-flowered; kernels slender. Empty glumes 20 to 24 millimeters long, 5 to 7 millimeters wide, 8 to 9 veined, light green before maturity. Lower lemma 15 to 18 millimeters long, glabrous, bright yellow; basal hairs few to absent; awns usually few, straight (nontwisted) to twisted and geniculate, 10 to 30 millimeters long. Rachilla segment mid-long, usually glabrous.

The Richland (Iowa No. 105) differs primarily from the original Kherson in having a slightly shorter straw. At time of ripening the empty glumes are a creamy white and the lemmas a distinct bright yellow. The variety ripens one day earlier than Kherson and two days later than Early Champion. It is resistant to stem rust of oats. A panicle and spikelets of Richland are shown in Figure 5.

In a varietal survey it was estimated that nearly 411,000 acres of this improved strain of Kherson were grown in 1919. More than 90 per cent of this acreage was reported from Iowa, as is shown in Figure 7. Despite favorable yields, however, the extension of Richland has been handicapped by its yellow color, as is proved by the fact that in 1924 the area devoted to it in Iowa had increased to only slightly less than a half million acres.



## YIELDS OF RICHLAND

## EXPERIMENTS AT THE IOWA STATION

Like the Albion variety, the yielding power of Richland has been determined in extensive varietal experiments conducted at the Iowa Agricultural Experiment Station. The annual and average yields of Richland and Kherson, the parent variety, for the 13 years from 1910 to 1919, inclusive, and in 1921, 1922, and 1923, together with the average date of sowing, date of ripening, height of plant, percentage of lodging, and bushel weight, are shown in Table 6.

According to the data presented in Table 6, Richland for the 13 years has outyielded the Kherson by 3.8 bushels per acre. While yields of Richland at the Iowa station as well as elsewhere have been very favorable, this variety has not shown the wide range of adaptability that has characterized the Albion. Further, a statis-

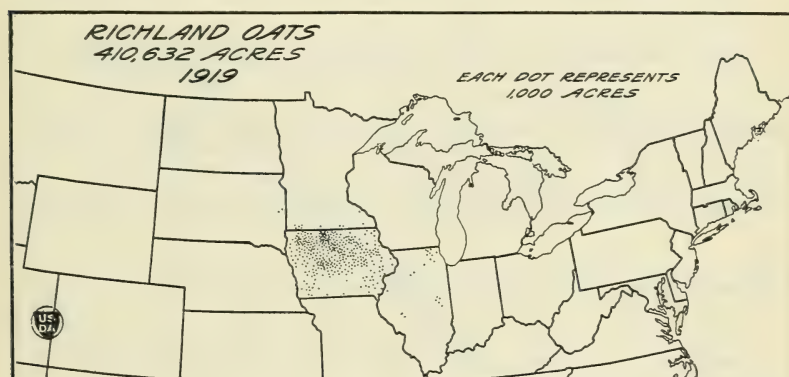


Fig. 7.—Outline map of a portion of the United States, showing distribution of the Richland oat in 1919

tistical study<sup>3</sup> of the yields of Richland and the parent variety Kherson, given in Table 6, shows odds of 19.5 to 1 that Richland is superior in yielding power.

TABLE 6.—Average dates of sowing and of ripening, height of plants, percentage of lodging, bushel weight, and annual and average acre yields of the Richland and Kherson oat varieties at the Iowa Agricultural Experiment Station for the 13 years from 1910 to 1919, inclusive, and in 1921, 1922, and 1923<sup>1</sup>

Items of comparison	Richland	Kherson	Items of comparison	Richland	Kherson
Average date sown.....	Apr. 14	Apr. 14	Acre yield of grain (bushels)—		
Average date ripe.....	July 12	July 13	Continued		
Average height of plant (inches).....	32	34	1916.....	53.3	53.8
Average percentage of lodging			1917.....	64.3	65.0
(8 years).....	0.4	1.0	1918.....	55.6	62.5
Acre yield of grain (bushels):			1919.....	47.5	41.9
1910.....	70.0	62.2	1921.....	37.2	25.9
1911.....	44.8	38.1	1922.....	65.0	67.1
1912.....	83.7	65.6	1923.....	78.1	78.7
1913.....	55.6	62.8			
1914.....	62.8	55.3	Average.....	59.8	56.0
1915.....	59.3	49.7	Average bushel weight, pounds	30.8	30.3

<sup>1</sup> No varietal experiments were conducted in 1920.

<sup>3</sup> See footnote 2, page 6.

The short straw has been an advantage only on the richer soils, and in some instances where the variety has been sown on less fertile land it has been too short for convenient harvesting. Richland is recommended primarily as a special-purpose variety for growing on rich soils where other varieties usually lodge and also in cases where the use of a short-strawed early oat as a nurse crop is an important consideration.

#### EXPERIMENTS ON IOWA FARMS

Richland also was included in the farm experiments of the Iowa Agricultural Experiment Association. One of the most interesting

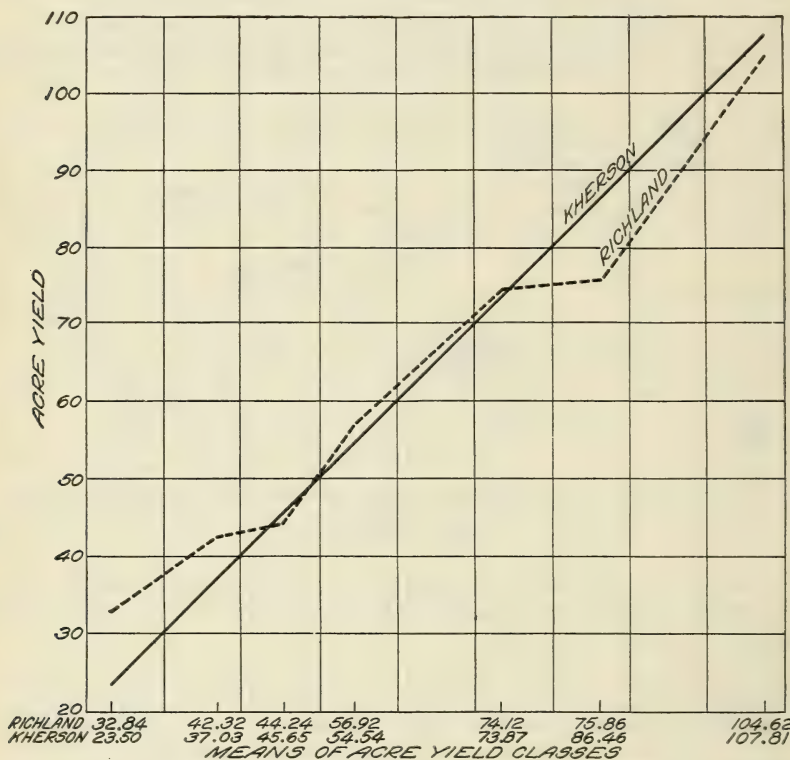


FIG. 8.—Diagram showing the mean acre yields (in bushels) of Richland as compared with those of Kherson as a standard oat variety in 46 trials on Iowa farms during the five-year period from 1914 to 1918, inclusive

phases of these experiments was the comparison of Richland with the parent variety Kherson. In Table 7 are given the annual average and weighted average yields of Richland and Kherson obtained on 46 Iowa farms during the five-year period from 1914 to 1918, inclusive.

The data in Table 7 show that on Iowa farms Richland outyielded its parent variety Kherson by only 1.3 bushels per acre during the five years from 1914 to 1918, inclusive. The almost identical yielding power of these varieties as indicated by the mean yields from the 46



farm tests is shown graphically in Figure 8. Space does not permit the presentation of these data in detail.

TABLE 7.—*Annual average and weighted average yields of the Richland and Kherson oat varieties grown on 46 Iowa farms during the five-year period from 1914 to 1918, inclusive*

Year	Number of trials	Acre yield of grain (bushels)		
		Richland	Kherson	Difference
1914.....	6	51.81	46.54	5.27
1915.....	9	57.87	51.57	6.30
1916.....	13	48.51	47.91	.60
1917.....	16	64.36	65.01	.65
1918.....	2	52.22	65.23	13.01
Weighted average of all trials.....	46	56.45	55.15	1.30

The Richland also was compared with a number of other home-grown varieties, 195 such comparisons being made. The varieties and number of trials in which each was compared with Richland were as follows: Early Champion 18, Silvermine 14, Swedish Select 20, Green Russian 29, Kherson 46, miscellaneous 36, and unknown 32. The average annual and weighted average yields in bushels per acre of the Richland and of the home-grown varieties, with their differences, are shown in Table 8.

TABLE 8.—*Average yields of Richland and other common varieties of oats grown on 195 Iowa farms during the five-year period from 1914 to 1918, inclusive*

Home-grown varieties	Number of trials	Acre yield of grain (bushels)		
		Richland	Home-grown variety	Difference
Early Champion.....	18	57.19	51.56	5.63
Silvermine.....	14	59.18	54.84	4.34
Swedish Select.....	20	41.77	39.22	2.55
Green Russian.....	29	48.98	46.90	2.08
Kherson.....	46	56.45	55.15	1.30
Miscellaneous varieties.....	36	52.67	50.49	2.18
Unknown varieties.....	32	54.91	52.32	2.59
Weighted average of all trials.....	195	53.15	50.61	2.54

From the data shown in Table 8, it will be seen that on the average Iowa farm Richland has exceeded the home-grown varieties in average yield from 1.3 to 5.6 bushels per acre.

#### COMPARATIVE YIELDS OF RICHLAND AND ALBION

##### EXPERIMENTS AT THE IOWA STATION

A comparison of the annual and average yields of Richland and Albion at the Iowa Agricultural Experiment Station is presented in Table 9.

TABLE 9.—*Annual and average acre yields of the Richland and Albion oat varieties at the Iowa Agricultural Experiment Station during the 13 years from 1910 to 1919, inclusive, and in 1921, 1922, and 1923*<sup>1</sup>

Year	Acre yields of grain (bushels)				Year	Acre yields of grain (bushels)			
	Richland	Albion	Difference in favor of—			Richland	Albion	Difference in favor of—	
			Richland	Albion				Richland	Albion
1910-----	70.0	55.4	14.6	-----	1918-----	55.6	48.7	6.9	-----
1911-----	44.8	40.6	4.2	-----	1919-----	47.5	32.2	15.3	-----
1912-----	83.7	53.7	30.0	-----	1921-----	37.2	37.4	-----	.2
1913-----	55.6	63.7	-----	8.1	1922-----	65.0	58.7	6.3	-----
1914-----	62.8	55.6	7.2	-----	1923-----	78.0	68.7	9.3	-----
1915-----	59.3	41.6	17.7	-----	Average-	59.8	52.0	7.8	-----
1916-----	53.3	46.1	7.2	-----					
1917-----	64.3	73.7	-----	9.4					

<sup>1</sup> No varietal experiments were conducted in 1920.

For the 13 years from 1910 to 1919, inclusive, and in 1921, 1922, and 1923, according to the data presented in Table 9, the Richland outyielded the Albion by nearly 8 bushels to the acre. This decided advantage in favor of Richland is not paralleled by the results on Iowa farms. However, the farm tests cover only two years, and the data, therefore, can not be considered as conclusive.

## EXPERIMENTS ON IOWA FARMS

During the years 1916 and 1917 the Iowa Agricultural Experiment Station distributed seed of both Albion and Richland to 54 farmers for trial. A summary of the yields obtained from these experiments is shown in Table 10.

TABLE 10.—*Average acre yields of Richland and Albion oat varieties from 54 separate comparative trials on Iowa farms in 1916 and 1917*

Year	Number of trials	Acre yields of grain (bushels)		
		Richland	Albion	Difference
1916-----	33	55.28	51.57	3.71
1917-----	21	59.59	60.84	1.25
Weighted average of all trials-----	54	56.96	55.18	1.78

In the 54 trials in which Richland and Albion oats were grown in adjacent acre plats, the Richland has exceeded the Albion by an average yield of only 1.78 bushels. These average results indicate that Richland when grown on ordinary prairie soil probably will not produce so well as on the more fertile soils of the Iowa Agricultural Experiment Station Farm. Apparently, on the average soils of the State these two varieties may be expected to give almost identical yields.

## RATE-OF-SEEDING EXPERIMENTS

Rate-of-seeding experiments with Richland were conducted during the 6-year period from 1912 to 1917, inclusive. In Table 11 are



given the annual and average acre yields of Richland oats sown at rates varying from 2 to 4½ bushels per acre.

TABLE 11.—*Annual and average acre yields (in bushels) of Richland oats sown in rate-of-seeding experiments at the Iowa Agricultural Experiment Station during the six-year period from 1912 to 1917, inclusive*

Year	Rate of seeding per acre					
	2 bushels	2½ bushels	3 bushels	3½ bushels	4 bushels	4½ bushels
1912.....	83.6	80.5	79.7	78.1	75.8	72.7
1913.....	70.6	68.7	72.5	76.9	72.8	67.5
1914.....	51.4	51.4	59.0	55.2	55.6	55.0
1915.....	82.3	83.4	82.3	83.6	81.6	83.6
1916.....	55.6	55.0	57.0	58.8	58.2	53.5
1917.....	73.7	78.1	87.5	87.5	81.2	68.7
Average.....	69.5	69.5	73.0	73.4	70.9	66.8

The data in Table 11 show that the optimum net rate of seeding for the 6-year period was 3 bushels per acre. Above this rate an increase in rate of seeding was not profitable, and above the 3½-bushel rate there was an actual decrease in yield, the decrease being greater with the increase in rate of seeding.

### IOWAR

Iowar, a white strain of Kherson, is the third pure-line oat variety developed in the cooperative oat experiments at the Iowa Agricultural Experiment Station that has been distributed to farmers.

### HISTORY AND DESCRIPTION

*History.*—Iowar was isolated from Kherson in 1910 by the senior writer. It was carried under the tentative designation of Iowa No. 779 and was named Iowar when first distributed to farmers. The nursery results in 1912, 1913, and 1914 were so favorable that it was increased and placed in the plat experiments in 1916. It was immediately apparent that this new strain excelled Albion in at least two very important characters, namely, in yielding ability and in height of plant. As there was a rather insistent demand for a variety of this type, it was decided to increase Iowar at once and to test it immediately on Iowa farms. The variety was first distributed to farmers of Iowa in 1919. Its increase and distribution have continued each year.

*Description.*—Early growth erect; plant early. Culms slender to midsized, weak, glabrous or slightly hairy at the nodes, 70 to 110 centimeters tall. Sheaths deep green, usually glabrous; culm leaves narrow to midwide, margins usually glabrous. Peduncle slender, straight, usually well exerted. Panicle equilateral, usually erect, midbroad, ovate; rachis nodes five to six; branches short to midlong, usually ascending, scabrous. Spikelets few to numerous, usually two-flowered; kernels slender. Empty glume 20 to 24 millimeters long, 5 to 7 millimeters wide, 8 to 9 veined, light green before maturity. Lower lemma 15 to 18 millimeters long, white; basal hairs few or

absent; awns usually rather abundant, straight (nontwisted) to twisted and geniculate, 15 to 35 millimeters long. Upper lemma 10 to 14 millimeters long, awnless. Rachilla segment midlong, usually glabrous.



FIG. 9.—Panicles and spikelets of the Iowar (left) and Iogren (right) oat varieties

Iowar differs from the Albion mainly in its slightly coarser and taller straw. Under average field conditions it grows about 2 inches taller than Albion. It also produces more awned spikelets, and the awns are distinctly dark at the base. At maturity the glumes are creamy white in color. It ripens about two days later than Kherson and three days later than Albion and Richland. A panicle and spikelets of Iowar are shown in Figure 9.



## YIELDS OF IOWAR

## EXPERIMENTS AT THE IOWA STATION

In two of the seven seasons that Iowar has been grown at the Iowa station the variety has been subject to mishap. In 1917 Iowar was badly damaged by flood, and in 1919 a large part of the grain was lost because of a storm which occurred after the variety was ripe and before it could be harvested. Data for six years are given, but the data of only five seasons are comparable as a basis for averages for this variety.

The average date of seeding, date of ripening, height of plant, percentage of lodging, bushel weight, and the annual and average yields of the Iowar, Kherson, Albion, and Richland varieties at the Iowa Agricultural Experiment Station for the seven years from 1916 to 1919, inclusive, and in 1921, 1922, and 1923 are given in Table 12.

TABLE 12.—Average dates of sowing and of ripening, height of plant, percentage of lodging, bushel weight, and the annual and average acre yields of the Iowar, Richland, Albion, and Kherson oat varieties at the Iowa Agricultural Experiment Station for the seven years from 1916 to 1919, inclusive, and in 1921, 1922, and 1923<sup>1</sup>

Items of comparison	Iowar	Kherson	Albion	Richland
Average date sown.....	Apr. 14	Apr. 14	Apr. 13	Apr. 14
Average date ripe.....	July 15	July 13	July 12	July 12
Average height of plant.....inches	36	34	34	31
Average percentage of lodging.....	24	6	11	4
Average yield of grain (bushels):				
1916.....	56.7	53.8	46.1	53.6
1917.....	57.5	65.0	73.7	64.3
1918.....	62.5	62.5	48.7	55.6
1919.....	( <sup>2</sup> )	41.9	32.2	47.5
1921.....	41.2	25.9	37.4	37.2
1922.....	60.6	67.8	58.7	65.0
1923.....	87.8	78.7	68.7	78.1
Average:				
1916-1918, 1921-1923.....	61.1	59.0	55.6	59.0
1916-1919, 1921-1923.....	—	56.5	52.2	57.3
1916, 1918, 1921-1923.....	61.8	57.7	51.9	57.9
Average bushel weight.....pounds	31.1	30.9	31.4	32.1

<sup>1</sup> No varietal experiments were conducted in 1920.

<sup>2</sup> Plat destroyed by storm.

The data presented in Table 12 show that Iowar was superior in yield to Albion and Richland as well as to the original Kherson. For the five years 1916, 1918, 1921, 1922, and 1923 it exceeded the average yield of Albion by 9.9 bushels per acre. The advantage over Kherson and Richland was less, however, being 4.1 and 3.9 bushels, respectively.

A statistical study<sup>4</sup> of the yields of Iowar and Kherson for the six years 1916, 1917, 1918, 1921, 1922, and 1923 show odds of 2.36 to 1 in favor of Iowar. Odds as small as these are of no significance. While the affected yield of Iowar for 1917 has been used in this analysis the abnormally low yield of Kherson for 1921, for which there is no apparent explanation, also has been considered.

<sup>4</sup> See footnote 2, page 6.

The weaker straw of Iowar is indicated by the higher percentage of lodging. In bushel weight Iowar was practically the equal of Kherson and Albion, but it was slightly inferior to Richland.

## EXPERIMENTS ON IOWA FARMS

The experiments at the Iowa station led to the belief that Iowar was a variety destined to replace Albion in a very large portion of

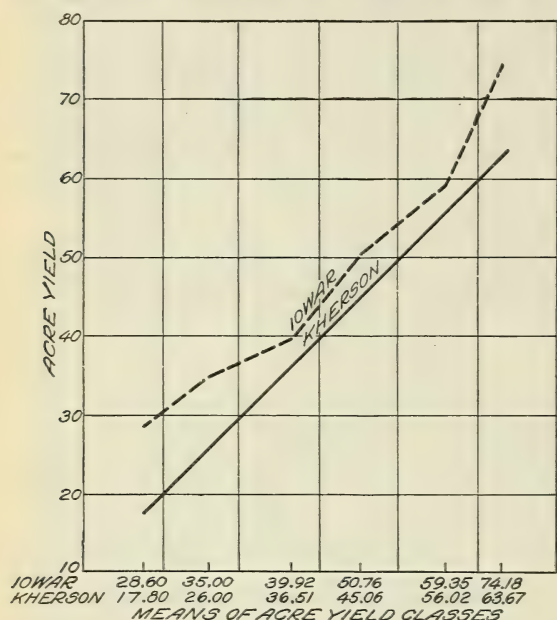


FIG. 10.—Diagram showing the mean acre yields (in bushels) of Iowar as compared with those of Kherson as a standard oat variety in 33 trials on Iowa farms during the five-year period from 1919 to 1923, inclusive

varieties as well as those that were not grown in sufficient numbers to warrant separate comparison are grouped together under the heading of miscellaneous varieties. A summary of the average yields of these varieties as compared with Iowar is given in Table 13.

TABLE 13.—Average acre yields of Iowar and other varieties of oats grown on 344 Iowa farms during the five-year period from 1919 to 1923, inclusive

Home-grown variety	Number of trials	Acre yields of grain (bushels)		
		Iowar	Home-grown variety	Difference
Kherson.....	33	49.81	44.46	5.35
Albion.....	153	51.12	44.31	6.81
Richland.....	42	52.93	46.54	6.39
Green Russian.....	31	49.89	45.24	4.65
Miscellaneous varieties.....	85	46.47	42.32	4.15
Weighted average of all trials.....	344	49.96	44.19	5.77

the State. Albion had been widely distributed both from the station and from commercial sources, and in the initial distribution and testing of Iowar it was requested that wherever convenient Albion be used as the home-grown variety. During the five years from 1919 to 1923, inclusive, Iowar was grown on 344 Iowa farms in comparison with home-grown varieties. The number of experiments and the varieties included were as follows: Kherson 33, Albion 153, Richland 42, Green Russian 31, and miscellaneous 85. The unknown home-grown



In the 153 comparisons of Iowar with Albion there was an average gain of 6.81 bushels per acre in favor of Iowar. For the 42 and 33 comparisons with Richland and Kherson the average gains in favor of Iowar were 6.39 and 5.35 bushels, respectively. In the weighted average Iowar exceeded the home-grown varieties by 5.77 bushels per acre. Comparisons of the mean yields of Iowar with Kherson, Albion, and Richland, based on the individual data from farm tests which are not presented in this bulletin, are shown graphically in Figures 10, 11, and 12. The popularity and rapid distribution of Iowar are evidenced by the fact that, as previously stated, more than three-fourths of a million acres were devoted to it in Iowa alone in 1924.

#### RATIO OF GRAIN TO STRAW

The Iowar oat yields not only more grain but also more straw than other early strains like Albion and Richland. The average height of straw of the varieties, as given in Table 12, is evidence of this fact. In addition, data obtained during the five-year period from 1918 to 1922, inclusive, when the Iowar oat was used on the soil-fertility field at the Iowa station, show that it produced a higher proportion of

straw to grain than the Albion on the same field during the preceding three-year period. The average acre yields and the proportion of grain to straw on 59 soil-fertility plats at the Iowa station for the five years from 1918 to 1922, inclusive, were 1,638 pounds of grain and 1,612 pounds of straw, or about 50 per cent of each, respectively.

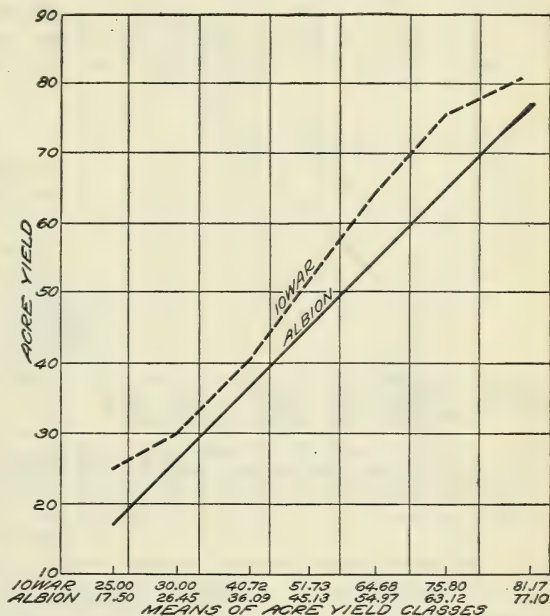


FIG. 11.—Diagram showing the mean acre yields (in bushels) of Iowar as compared with those of Albion as a standard oat variety in 153 trials on Iowa farms during the five-year period from 1919 to 1923, inclusive.

TABLE 14.—Annual and average acre yields (in bushels) of the Iowar oat grown in rate-of-seeding experiments at the Iowa Agricultural Experiment Station during the five years 1917, 1918, 1920, 1921, and 1922

Year	Rates of seeding per acre					
	2 bushels	2½ bushels	3 bushels	3½ bushels	4 bushels	4½ bushels
1917	87.5	91.2	97.5	102.4	109.4	110.0
1918	55.6	58.7	53.7	58.1	55.0	58.1
1920	80.6	79.4	85.0	86.9	86.2	78.7
1921	39.8	48.4	51.6	55.1	57.6	48.4
1922	77.5	83.1	78.1	80.0	80.0	83.1
Average	68.2	72.2	73.2	76.5	77.6	75.7

## RATE-OF-SEEDING EXPERIMENTS

The Iowar oat was grown in rate-of-seeding experiments during the five years 1917, 1918, 1920, 1921, and 1922, and the annual and average yields obtained in these experiments are given in Table 14.

The data presented in Table 14 show that the highest net average yields have been obtained from seeding at a rate of 4 bushels to the acre. This is a higher rate than has proved profitable with other

varieties previously grown in such experiments. The results indicate that a rate of more than 3 bushels is advisable for this variety.

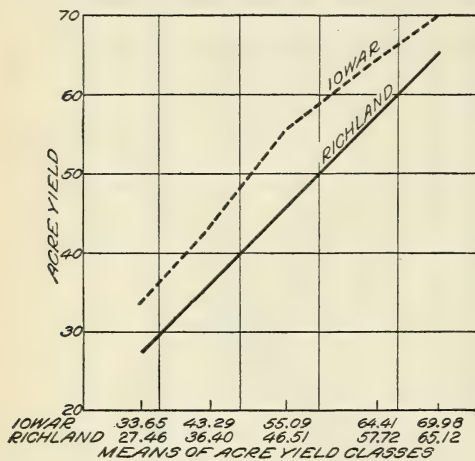


FIG. 12.—Diagram showing the mean acre yields (in bushels of Iowar as compared with those of Richland as a standard oat variety in 42 trials on Iowa farms during the five-year period from 1919 to 1923, inclusive.

## IOGREN

Iogren is the fourth important pure-line oat developed in and distributed from the cooperative cereal experiments at the Iowa Agricultural Experiment Station. For many years the parent variety, Green Russian, has been one of the leading varieties in northwestern Iowa. The extent and density of the distribution of this variety in 1919 are strikingly shown in Figure 13. The

fact that the Green Russian variety has persisted in that section of Iowa indicates its excellent adaptability to existing soil and climatic conditions. For this reason the development of Iogren, a uniform high-yielding strain of the Green Russian type, seemed particularly desirable. The history of the Iogren and its description follow.

## HISTORY AND DESCRIPTION

*History.*—The Iogren was developed from a single head of the Green Russian variety obtained from W. Eral, Pocahontas, Iowa. It was grown in a head row at the Iowa station in 1911 and was designated Iowa No. 840. The selection was grown in the nursery experiments in 1912, 1913, and 1914, and was advanced to the plat experiments in 1916. Iogren was first distributed to farmers in Iowa in 1922.

*Description.*—Early growth erect; plant midseason. Culms mid-sized, stiff, glabrous or slightly hairy at the nodes, 80 to 130 centimeters tall. Sheaths deep green, usually glabrous; culm leaves mid-sized, margins usually glabrous. Peduncle mid-sized, straight, well



exserted. Panicle equilateral, drooping, midlong to long, wide, ovate; branches spreading to ascending, uppermost branch long, very drooping, distinct; rachis nodes 5 to 7. Spikelets few to many, usually 2-flowered; kernels slender. Empty glumes 20 to 25 millimeters long, 5.5 to 7.5 millimeters wide, 9 to 10 veined. Lower lemma 16 to 20 millimeters long, yellow to yellowish white; upper end with greenish tinge at maturity; basal hairs few to absent; awns few to common, straight (nontwisted) to twisted and geniculate, 15 to 35 millimeters long. Upper lemma 11 to 16 millimeters, awnless. Rachilla segment midlong, usually glabrous.

Iogren is a rather tall midseason yellow variety, with mid-sized panicles. It usually can be recognized by its peculiarly long, drooping uppermost branches, and frequently by the greenish tinge or



FIG. 13.—Outline map of a portion of the United States, showing distribution of the Green Russian oat in 1919

color of the upper end of the lemmas. The glumes at time of ripening are a creamy to greenish yellow color. It ripens at the same time as the parent variety, Green Russian. Under the environment of Ames, Iowa, the Iogren and a few other selections from the Green Russian parent have shown some resistance to stem rust. A panicle and spikelets of Iogren are shown in Figure 9.

#### YIELDS OF IOGREN

##### EXPERIMENTS AT THE IOWA STATION

Like the other pure lines previously described, Iogren was thoroughly tested at the Iowa Agricultural Experiment Station to determine its yielding power. The average dates of sowing and of ripening, height of plant, percentage of lodging, bushel weight, and the annual and average acre yields of Iogren and of the parent variety, Green Russian, grown in varietal experiments at the Iowa station for the seven years from 1916 to 1919, inclusive, and in 1921, 1922, and 1923 are shown in Table 15.

TABLE 15.—Average dates of sowing and of ripening, height of plant, percentage of lodging, bushel weight, and the annual and average acre yields of the Iogren and Green Russian oat varieties at the Iowa Agricultural Experiment Station for the seven years from 1916 to 1919, inclusive, and in 1921, 1922, and 1923<sup>1</sup>

Items of comparison	Iogren	Green Russian	Items of comparison	Iogren	Green Russian
Average date sown.....	Apr. 16	Apr. 16	1919.....	50.0	45.9
Average date ripe.....	July 20	July 19	1921.....	40.6	37.8
Average height of plant, inches.....	40.9	40.1	1922.....	65.0	57.5
Average percentage of lodging.....	2.1	4.3	1923.....	84.7	74.7
Acre yields of grain (bushels):			Average.....	64.2	56.3
1916.....	64.4	53.6	Average bushel weight.....		
1917.....	62.5	50.0	-----pounds.....	32.0	31.7
1918.....	82.5	74.4			

<sup>1</sup> No varietal experiments were conducted in 1920.

According to the yield data presented in Table 15, during the seven years in which they have been compared Iogren has outyielded Green Russian by 7.9 bushels to the acre. A statistical study<sup>5</sup> of this difference indicates odds of 1,999 to 1 that Iogren will outyield the parent variety, Green Russian.

In time of ripening Iogren is about one day later than Green Russian. In weight per bushel it is slightly superior.

#### EXPERIMENTS ON IOWA FARMS

Iogren was grown on Iowa farms in comparison with the parent variety (Green Russian), Iowar, and other miscellaneous varieties during the seasons of 1922 and 1923. The number of farm experiments in which Iogren was compared with other varieties was as follows: Green Russian 25, Iowar 35, and miscellaneous 51. A summary of the average yields of these experiments is given in Table 16.

TABLE 16.—Average yields of Iogren and other oat varieties grown on 111 Iowa farms in 1922 and 1923

Home-grown varieties	Number of trials	Acre yield of grain (bushels)		
		Iogren	Home-grown varieties	Difference
Green Russian.....	25	49.91	44.87	5.04
Iowar.....	35	49.80	48.09	1.71
Miscellaneous varieties.....	51	48.66	44.38	4.28
Weighted average of all trials.....	111	49.30	45.66	3.64

The data presented in Table 16 show an average difference of 5.04 bushels in favor of Iogren over the parent variety, Green Russian. For the 111 separate trials the average yield for Iogren was

<sup>5</sup> See footnote 2, page 6.



49.30 bushels, as compared with 45.66 bushels for the home-grown varieties. The mean yields of the Iogren as compared with those of the Green Russian and Iowar, based on the individual data from the separate farm tests, are shown graphically in Figures 14 and 15.

#### RATE-OF-SEEDING EXPERIMENTS

During the years 1917 and 1920 to 1923, inclusive, Iogren was grown in rate-of-seeding experiments. The annual and average yields are presented in Table 17.

From the data presented in Table 17 it is evident that the heavier rates of seeding produced the highest yields. Three bushels per acre has been considered the standard rate. In two of the five trials with Iogren this rate has given the highest yield. In the other three trials higher rates have given higher yields. The results so far obtained would indicate that the rate of seeding might profitably be increased to 4 bushels per acre.

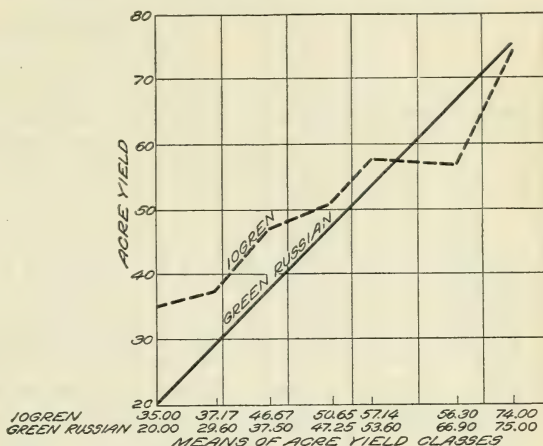


FIG. 14.—Diagram showing the mean acre yields (in bushels) of Iogren as compared with those of Green Russian as a standard oat variety in 25 trials on Iowa farms in 1922 and 1923

TABLE 17.—Annual and average acre yields (in bushels) of the Iogren oat grown in rate-of-seeding experiments at the Iowa Agricultural Experiment Station during the five years, 1917 and 1920 to 1923, inclusive

Year	Rate of seeding per acre					
	2 bushels	2½ bushels	3 bushels	3½ bushels	4 bushels	4½ bushels
1917.....	56.9	56.9	56.9	58.1	68.1	71.9
1920.....	75.0	81.6	85.0	80.0	82.5	76.9
1921.....	35.8	38.4	37.1	37.2	44.0	38.6
1922.....	49.4	51.2	52.2	53.7	52.8	55.6
1923.....	75.3	75.6	79.4	76.2	77.8	76.9
Average.....	58.5	60.7	62.1	61.0	65.0	64.0

#### YIELDS OF OTHER VARIETIES AT THE IOWA STATION

To present more fully the behavior of the new oat varieties, Albion, Richland, Iowar, and Iogren, described in this bulletin, it is desirable to show data on the yielding power of other early, midseason, and late varieties at the Iowa Agricultural Experiment Station. Therefore, the annual and average yields of the varieties which have been grown continuously since the inclusion of the Albion and Richland in the varietal tests at Ames in 1911 are shown in Table 18.

TABLE 18.—Annual and average acre yields of Albion, Richland, Iowar, Iogren, and 11 other varieties of oats grown in cooperative experiments at the Iowa Agricultural Experiment Station during seven or more years of the 12-year period from 1911 to 1919, inclusive, and in 1921, 1922, and 1923

Group and variety	Acre yields (bushels)														Average	
	1911	1912	1913	1914	1915	1916	1917	1918	1919	1921	1922	1923	1911 to 1919 and 1921 to 1923	1916 to 1919 and 1921 to 1923		
Early yellow:																
Kherson.....	38.1	65.6	62.8	55.3	49.1	53.8	65.0	62.5	41.9	25.9	67.8	78.7	55.5	56.5		
Richland.....	44.8	83.7	55.6	62.8	59.3	53.6	64.3	55.6	47.5	37.2	65.0	78.1	59.0	57.3		
Early white:																
Albion.....	40.6	53.7	63.7	55.6	41.6	46.1	73.7	48.7	32.2	37.4	58.7	68.7	51.7	52.2		
Iowar.....						56.7	57.5	62.5	(1)	41.2	60.6	87.8	52.2	61.1		
Daubeney.....	31.0	71.2	50.3	48.1	50.9	52.4	81.9	64.3	50.3	19.4	62.5	73.4	54.6	57.7		
Early Champion.....	35.0	48.1	50.6	48.4	42.2	48.7	68.1	43.7	25.3	28.4	50.9	72.7	46.8	48.3		
Early red:																
Burt.....	40.6	60.6	52.1	45.6	54.7	55.3	79.4	42.5	40.0	25.0	57.8	76.6	52.5	53.8		
Red Rustproof (Texas Red) <sup>3</sup>	5.9	68.7	49.1	44.7	54.4	51.2	66.2	88.1	50.3	23.4	51.9	44.1	49.8	53.6		
Midseason white:																
Silvermine.....	36.3	81.9	60.3	46.8	55.2	51.7	71.2	70.0	35.0	28.4	57.5	75.6	55.8	55.6		
Green Russian.....	31.8	83.7	53.4	45.7	57.6	53.6	50.0	74.4	45.9	37.8	57.5	74.7	55.5	56.3		
Iogren.....						64.4	62.5	82.5	50.0	40.6	65.0	84.7	58.0	64.2		
Early Gothland.....	23.6	80.0	62.8	43.1	60.7	50.0	53.7	90.6	(*)	30.9	52.2	70.6	58.0	58.0		
Swedish Select.....	25.5	75.0	50.6	37.6	44.8	43.0	63.7	65.0	23.1	35.6	62.5	73.7	50.0	52.4		
Midseason black:																
Joanette.....	23.9	88.7	50.2	43.7	60.6	52.6	66.9	81.9	62.2	45.3	55.3	66.6	58.2	61.5		
Late white (side):																
White Tartar (White Russian).....	19.8	83.1	46.6	44.4	52.3	41.4	35.0	73.4	21.2	38.1	42.8	50.0	45.7	43.1		

<sup>1</sup> Plat destroyed by storm.

<sup>2</sup> Average for 1916, 1917, 1918, 1921, 1922, and 1923.

<sup>3</sup> Red Rustproof under the environment of Ames ripens later than midseason but earlier than late oats.

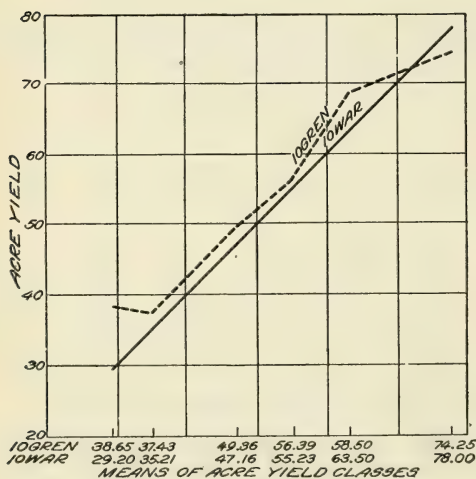


FIG. 15.—Diagram showing the mean acre yields (in bushels) of Iogren as compared with those of Iowar as a standard oat variety in 35 trials on Iowa farms in 1922 and 1923

Reference to the data presented in Table 18 shows that of the 12 varieties grown continuously for the 12 years from 1911 to 1919, inclusive, and in 1921, 1922, and 1923, Richland produced the highest average yield, with the midseason black oat, Joanette, a close second. Albion was exceeded in yield by seven varieties. Of the midseason varieties, Silvermine and Green Russian were superior, their average yield being practically the same as that of Kherson. During the seven years from 1916 to 1919, inclusive, and in 1921, 1922, and



1923, Iogren was the highest yielder, Joannette being second and Iowar third. This result demonstrates the value of Iowar and Iogren for growing in the Corn Belt.

#### YIELDS OF ALBION, RICHLAND, AND IOWAR OATS OUTSIDE OF IOWA

The adaptation and yielding power of these new varieties in States near Iowa is of interest. Conditions within a rather distinct area extending from western Ohio through Indiana, Illinois, and including practically all of Iowa are quite similar, this being the central portion of the Corn Belt, and it was believed that these new varieties might find a place elsewhere in this area.

The Office of Cereal Investigations in 1916 distributed Albion and Richland to the various field stations in the Great Plains, the western Great Basin, and the coast areas where cooperative experiments with oats were being conducted. Iowar and Iogren likewise have been distributed in later years. In addition, the various State agricultural experiment stations placed these improved sorts in their varietal experiments. As a result considerable data are now available, particularly for Albion and Richland, which show their performance in comparison with older standard varieties.

Through the courtesy of the agronomy departments of the State agricultural experiment stations it is possible to present a rather complete resumé of the average yields of these improved varieties in comparison with the yields of parent and of other standard varieties in surrounding Corn Belt and other States.

The State stations which furnished data are the following: Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Missouri, North Dakota, Nebraska, and Kansas. Data also have been summarized from the annual reports of the following stations and substations at which the Office of Cereal Investigations is now or was formerly cooperating: Brookings, Highmore, and Newell, S. Dak.; Dickinson and Williston, N. Dak.; Moccasin, Mont.; Cheyenne and Sheridan, Wyo.; Akron, Colo.; Aberdeen, Idaho; Nephi, Utah; and Moro, Oreg.

A summary of data obtained at 22 experiment stations in the Corn Belt, Great Plains, western Great Basin, and coast areas of the United States on the average yield of Albion, Richland, and Iowar, the parent varieties Kherson and Sixty-Day, and nine other standard varieties of oats is presented in Table 19. In a few instances it has been necessary to substitute the yields of identical or similar varieties, such cases being indicated.

TABLE 19.—Average yields of Albion, Richland, Iowar, the parent varieties Kherson and Sixty-Day, and nine other varieties of oats grown at 22 experiment stations outside of Iowa for periods varying from three to eight years

[Data not obtained in cooperative experiments with the Office of Cereal Investigations are presented by courtesy of the agronomy departments of the respective State agricultural experiment stations]

State and location of station	Years grown	Years of data	Variety and average acre yield (bushels)													
			Albion	Richland	Iowar	Kher-son	Sixty-Day	Silver-mine	Swed-ish Select	Victory	Minota	Lincoln	Golden Rain	White Tartar	Burt	Ful-gum
Ohio:																
Wooster.....	7	1917-1923	63.5	66.8				67.2	66.6	1 63.1		2 69.1				
Indiana:																
La Fayette.....	5	1919-1923	43.0	41.1						47.2		3 46.1			47.5	
Illinois:											54.7					
De Kalb.....	6	{ 1917-1919 1920-1923 }	72.0	72.4	4 70.1		68.2	71.0	5 68.9							
Urbana.....	8	1916-1923	58.6	57.2	6 53.4		54.1	55.3	5 56.5							
Michigan:																
East Lansing.....	3	1922-1924	34.4		58.1			7 65.6								
Wisconsin:																
Madison.....	5	1917-1921	61.5	61.4		8 68.0						8 53.5				
Minnesota:																
St. Paul.....	4	1917-1920	60.0							68.8						
Missouri:																
Columbia.....	3	1921-1923	34.9	33.9		38.5	36.2								44.5	45.9
North Dakota:																
Williston.....	6	{ 1916-1918 1920-1922 }	43.3	42.1			43.6	47.0	9 47.2			50.0	43.4	38.3		
Dickinson.....	8	1916-1923	10 40.2	40.4		40.5		44.6		44.7		11 46.1		38.3		
South Dakota:																
Brookings.....	4	1916-1919	68.1	71.7	12 68.7		72.9	46.4	47.9				42.9			
Brookings.....	5	1916-1920	38.6	41.4	13 52.3		47.2	32.0	24.3				21.8			
Highmore.....	4	1916-1919	27.7	27.1	13 30.8		29.2		22.4					20.4	29.4	
Newell.....																
Nebraska:																
Lincoln.....	6	{ 1916-1918 1920-1923 }	49.7	48.4	14 50.6	47.6			41.7			13 42.3				
Kansas:																
Manhattan.....	5	1919-1923	33.1	34.9		33.0									32.2	16 48.7
Montana:																
Moccasin.....	8	1916-1923	45.4	49.0			48.2	51.5		48.8		50.5				
Wyoming:																
Cheyenne.....	7	{ 1916-1921 1923 }	25.8	29.0		33.0	39.5		26.9	17 30.2			29.8			
Sheridan.....	7	1916-1923	32.9				39.5	35.7	33.8				37.7	27.5		



Colorado:	8	1916-1923	21.2	21.7	20 94.6	14.5	23 55.0	24 54.5	14.0	19 22.1
Akron.....	8	1916-1923	91.9	10 91.8					100.5	
Idaho:	0	1916-1921	17.1	21 16.5	16.0	19.5				
Aberdeen.....	8	1916-1923	47.0	50.9	49.0	48.9				
Utah:										
Nephi.....										
Oregon:										
Moro.....										

<sup>1</sup> Yield of the commercial variety Big Four substituted.

<sup>2</sup> Yield of the commercial variety Improved American substituted.

<sup>3</sup> Yield of the Wisconsin Pedigree No. 1 variety substituted.

<sup>4</sup> Average for the three years 1921, 1922, and 1923.

<sup>5</sup> Yield of the selection Minnesota No. 6 substituted.

<sup>6</sup> Average for the two years 1922 and 1923 only.

<sup>7</sup> Yield of the Michigan selection Wolverine substituted.

<sup>8</sup> Yield of States Pride, a Wisconsin selection of Kheron, substituted.

<sup>9</sup> Yield of the commercial variety Abundance substituted.

<sup>10</sup> Annual yields of Iowa for 1922 and 1923 included in average yield of Albion.

<sup>11</sup> Yield of Siberian (C. I. No. 741) substituted.

<sup>12</sup> Yield of Cole, a South Dakota selection from Sixty-Day, substituted.

<sup>13</sup> Yield of the Sixty-Day selection C. I. No. 626.

<sup>14</sup> Yield of Nebraska No. 21, a selection from Kheron.

<sup>15</sup> Yield of the commercial variety American Banner substituted.

<sup>16</sup> Yield of Kanota. Comparable yield of Red Rustproof, 37.5 bushels.

<sup>17</sup> Five-year average only.

<sup>18</sup> Yield of Colburt, a black selection from Burt.

<sup>19</sup> Average yield for the seven years 1916 to 1922, inclusive.

<sup>20</sup> Annual yields of Idamaine, a Silvermine selection, for the three years 1921, 1922, and 1923 included in the average yield for Silvermine.

<sup>21</sup> Yield of the Ligowa variety substituted.

<sup>22</sup> Yield of the selection of Sixty-Day (C. I. No. 165-1), substituted.

<sup>23</sup> Yield of the Markton variety substituted.

<sup>24</sup> Yield of the commercial variety known as Three-Grain.

Reference to Table 19 shows that in general the selections Albion, Richland, and Iowar slightly outyielded the parent varieties, Kherson and Sixty-Day.<sup>6</sup> As a consequence, where early varieties of this type are most satisfactory, these improved strains are preferable to the parent varieties. In addition to their slightly higher yielding power these selected strains are decidedly more uniform and usually produce grain of better quality, the white kernels of the Albion and Iowar being also particularly desirable.

The data also show rather definitely the range of adaptability of Albion, Richland, and Iowar both by their average yields and by the average yields of the parent varieties, Kherson and Sixty-Day. At Wooster, Ohio, the original Sixty-Day outyields both Albion and Richland, the difference between Richland and the parent variety being so slight, however, that it can not be considered as significant. At this station Lincoln, a midseason white oat, has produced on the average 1.9 bushels per acre more than the Sixty-Day.

Neither Albion nor Richland compares favorably in yield with such midseason varieties as Swedish Select, Lincoln, and Minota at La Fayette, Ind. At this station Burt, an early red oat, also has decidedly outyielded these improved Kherson strains. Unfortunately, the parent varieties, Kherson and Sixty-Day, were not grown at La Fayette during the period covered by these data.

Albion and Richland have shown in Illinois a rather consistent superiority to the parent variety, Sixty-Day, as well as to the best midseason oats, such as Silvermine, Swedish Select, and Lincoln. These two varieties apparently are well adapted for growing in central and northern Illinois.

Albion and Iowar can not compete in Michigan in yield with such midseason varieties as Wolverine and Worthy.

At Madison, Wis., States Pride (Wisconsin Pedigree No. 7), a tall yellow selection of Kherson, has outyielded Albion and Richland by about 6.5 bushels per acre during the five years from 1917 to 1921, inclusive. Both the Iowa selections have decidedly outyielded the Lincoln variety, a midseason white oat.

At St. Paul, Minn., Albion has been inferior in yield to Victory, one of the best midseason varieties for that State. Albion can be recommended in Minnesota only where an early variety is desirable as a nurse crop or because of some other similar reason.

At Columbia, Mo., both the Burt and Fulghum, early red varieties, have decidedly outyielded both Albion and Richland as well as the parent varieties, Kherson and Sixty-Day.

In North Dakota, at both Dickinson and Williston, there has been essentially no difference in yield between the Iowa selections and the parent varieties. In this State the midseason varieties, Silvermine, Lincoln, Swedish Select, Victory, etc., outyield the early varieties and are preferable.

Albion and Richland have been slightly inferior in yield to the parents, Kherson and Sixty-Day, at Brookings, Highmore, and Newell, S. Dak. These early oats as a group are much superior in

<sup>6</sup> For a history of the introduction of Kherson and Sixty-Day oats into the United States see Department Bulletin 823, *Experiments with Kherson and Sixty-Day Oats*, by C. W. Warburton and T. R. Stanton. Botanically the Kherson and Sixty-Day are identical varieties. White-kerneled strains have been selected from both.



yielding ability to midseason varieties, such as Silvermine and Swedish Select, and are to be highly recommended for that State.

At Lincoln, Nebr., Albion and Richland have both slightly outyielded the parent variety, Kherson, and therefore are well adapted for growing in that State. Nebraska No. 21, a strain morphologically identical with Albion, has been equally satisfactory.

At Manhattan, Kans., Kanota, a strain of Fulghum, has been decidedly superior in yield to the Iowa selections. This variety is being recommended by the Kansas station.

At Moccasin, Mont., the results are similar to those in North Dakota. Silvermine, the highest yielding variety, however, has exceeded the yield of Richland by only 2.5 bushels per acre. Richland, in turn, has outyielded the parent variety, Sixty-Day, only slightly.

In Wyoming, at Cheyenne, both Albion and Richland have produced lower average yields than Kherson. The early varieties as a group, however, are equal in yield to the best midseason varieties, such as Victory, Ligowa, and Golden Rain. At Sheridan, Wyo., Albion has been exceeded in yield by the midseason varieties, Silvermine and Swedish Select, but the parent variety, Sixty-Day, has produced the highest yield of all.

In Colorado the results at Akron show Albion to be practically identical in yield with the Kherson parent. Burt is very slightly superior to both these varieties, although not significantly so.

Under irrigation at Aberdeen in southern Idaho the early varieties can not compete with Golden Rain, Idamine, and other later maturing oats.

At Nephi, Utah, Albion has outyielded the Sixty-Day parent over a six-year period by only 1.1 bushels. Swedish Select, a midseason white oat, has outyielded Albion by 2.4 bushels and is preferable to any of the earlier varieties.

At Moro, Oreg., there has been little difference in the yields of Albion and Richland and those of the parent varieties, Kherson and Sixty-Day. Such midseason varieties as Markton and Three-Grain, however, produce higher yields than any of the early types and therefore are to be recommended.

### SUMMARY

In this bulletin there are described four oat varieties, Albion, Richland, Iowar, and Iogren, which have been developed cooperatively by the Iowa Agricultural Experiment Station and the Office of Cereal Investigations of the Bureau of Plant Industry, United States Department of Agriculture.

Albion was developed from a single plant selected from Kherson in 1906. Owing to the demand for an early variety with white kernels, even though Albion did not show superiority in yield to Kherson, its distribution was begun in 1913. The variety immediately became popular, and it was estimated that nearly 1,500,000 acres were grown in the Corn Belt in 1919, while in 1924 almost this acreage was grown in Iowa alone.

Richland, an early yellow oat, is a companion strain of Albion and has about the same history. It was selected from Kherson in 1906, primarily because of its short, rather stiff culm. It was first distributed in 1914. In yielding power it is superior to both Kherson

and Albion, and because of its short straw it is especially recommended for growing on rich soils where taller varieties frequently cause partial loss of the crop by lodging.

Iowar was selected in 1911 from Kherson and differs from Albion in having a taller culm and in being a little later in maturity. It is superior in yielding power to Kherson and Albion. It was first distributed in 1919. Iowar is the most promising of the three early varieties here discussed and already has attained a wide distribution in Iowa and adjoining States. The variety probably will replace Albion to a considerable extent because of its higher yielding ability and its taller straw.

Iogren, a selection from Green Russian, was increased from an original plant selection made in 1910. The variety was first distributed to farmers in 1922. Iogren has been markedly superior in yield to the parent, Green Russian, and it is believed will ultimately largely replace that variety in northern Iowa. Of all the varieties grown in the experiments at Ames, Iogren has been the highest yielder.

Albion, Richland, and Iowar have been most promising in States other than Iowa in those sections where the parent sorts, Kherson and Sixty-Day, have been the leading varieties. Since in such areas the selections usually slightly outyield the parent varieties, they may profitably be substituted where Kherson or Sixty-Day is grown.



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